



NASA Langley's Miniature Low-Power X-ray Tube

Improved X-ray generation using a microchannel
electron generator electron source

NASA Langley scientists have successfully integrated an electron generator into a sealed X-ray tube to create a low-power, reliable miniature X-ray source for use in analytical instrumentation. The electron generator replaces traditional tungsten filaments in X-ray tubes used to generate electrons. Tungsten filaments operate at high temperatures, requiring a relatively high current power source to emit electrons, and they are fragile. The replacement of the tungsten filament with an electron generator requires only a voltage power source, uses very little current, and does not have cooling requirements. The tubes utilizing the electron generator are more rugged X-ray tubes with a longer lifetime. Additionally, the X-ray tube is much smaller (approximately eight centimeters in length) than conventional tubes as is consequently appropriate for handheld or portable instruments. This electron generator also enables directional control of electron flow and can be stacked to increase electron intensity.

Benefits

- Miniaturized X-ray tube
- Dramatically reduced X-ray tube power consumption
- More robustness and greater life expectancy than traditional tungsten filaments
- Stackable, in order to increase X-ray output
- Easily integrated into analytical instruments and industrial applications
- Room temperature operation as opposed to conventional filament temperatures of approximately 1500°C
- Relatively low voltage required to initiate and direct electrons

partnership opportunity



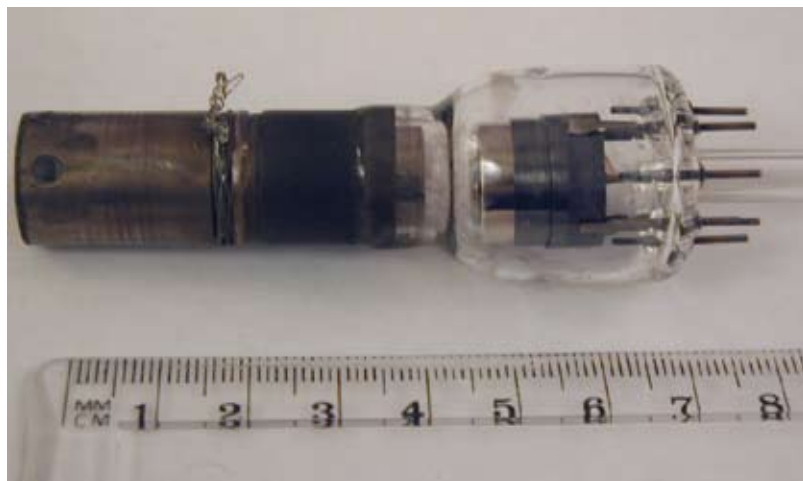
Applications

This miniature X-ray tube has potential application in any technology using traditional tungsten filament X-ray tubes, including:

- Dental X-rays
- Medical imaging devices
- Aerospace imaging used in planetary and space missions
- Security imaging
- Analytical instrumentation, particularly handheld or portable devices

The Technology

This technology represents the first time that a room-temperature electron generator has been integrated into an X-ray tube. The X-ray tubes are constructed using a sealed glass envelope with a rhodium anode and a beryllium window. The tube requires very little current and requires only a voltage power source for operation. The major disadvantage of modern X-ray tubes is a limited lifetime and significant electrical power consumption. The power consumption is a major disadvantage for many experiments using X-ray tubes. The power in traditional tubes is consumed by the high voltage that accelerates the electron beam and the electron current source that generates the electrons. These new X-ray tubes can reduce the power consumption by about half because they require only a voltage source. Additionally, this new X-ray tube operates at room temperature, making it much less susceptible to heat degradation unlike conventional tubes, and can be stacked to facilitate increased X-ray output for experiments requiring it. The small size of the electron source allows the tubes to be miniaturized and consequently, optimal for portable instrumentation.



Miniature X-ray tube with electron generator

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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